Adapter INNBOX PLC 500M

User Manual

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TABLE OF CONTENTS

1 INTRODUCTION 5
1.1 Product Features 5
1.2 Application 5
1.3 System Requirements 5
2 SAFETY PRECAUTIONS 6
3 GETTING TO KNOW THE ADAPTER 7
3.1 The Ethernet Interface 7
3.2 The Adapter's Buttons 7
3.3 The Adapter's LEDs 7
5 HOW TO INSTALL THE UTILITY 9
6 HOW TO USE THE UTILITY 12
6.1 Main Tab 12
6.2 Privacy Tab 14
6.3 Diagnostics Tab 15
6.4 About Tab 16
7 FORMING A HOMEPLUG AV LOGICAL NETWORK 17
7.1 Using the Security\Reset Pushbutton 17
7.2 Using the Utility 17
8 JOINING A NETWORK 18
8.1 Using the Security\Reset Pushbutton 18
8.2 Using the Utility 19
9 HOW TO IMPROVE THE TRANSMISSION CAPACITY 19
APPENDIX A: SPECIFICATIONS 20
APPENDIX B: ACRONYMS AND ABBREVIATIONS 21
APPENDIX C: ABOUT QOS 22

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1 INTRODUCTION

The Innbox PLC500M is a mini-PLC adapter. It can transmit data up to 500Mbps within the household powerline. It can be connected to the power socket directly without any additional new wire. The Innbox PLC500M adapter can enter power save mode triggered by multiple conditions. It can help you to establish a high-speed network that supports video, voice and data without wiring and drilling. It is suitable for using in a wide range of both residential (at home) and commercial (offices, apartments, hotels, warehouses) network applications.

1.1 Product Features

- No new wires needed. Every power socket in the household can become a communication node.
- Provides data connectivity to your routers, computers and other networking devices in Plug-and-Play manner.
- Provides power save mode, where the output consumption of the device is less than 0.5W.
- Up to 500Mbps physical data rate

1.2 Application

- High Definition (HD) and Standard Definition (SD) video distribution
- Higher data rate broadband sharing for powerline LAN
- Shared broadband internet access
- TV over IP (IPTV) and Voice over Internet Protocol (VoIP)

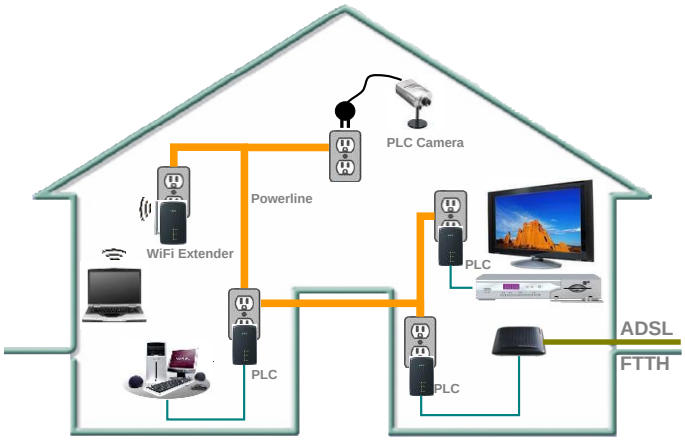

Figure 1 PLC network architecture

1.3 System Requirements

- Operating system: Windows 98SE, 2000, ME, XP 32/64 bit, Vista 32/64bit and WIN7 32/64bit
- CPU: Intel Pentium III or better, clock rate faster than 2.0GHz recommended
- RAM: At least 128MB
- Screen resolution: Any resolution
- Free disk space: At least 20MB
- Network interface: At least one Fast Ethernet (100 Mbps) network card and Ethernet patch cord.

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2 SAFETY PRECAUTIONS

This device is intended to be used for connection to the AC powerline. For installation instructions, please refer to the installation section of this guide. The following precautions should be taken when using this product.

- Read all instructions before installing and operating this product.
- Follow all warnings and instructions marked on the product.
- Unplug the device from the wall outlet before cleaning. Use a damp cloth for cleaning. Do not use liquid cleaners or aerosol cleaners.
- Do not operate this product near water.
- This product should never be placed near or over a radiator or heat register.
- Do not use an extension cord between the device and the AC power source.
- Only a qualified technician should service this product. Opening or removing covers may result in exposure to dangerous voltage points or other risks.
- Do not plug the device into a power strip or surge protector because these devices may consist of filter and impair signal.
- Avoid plugging the device right next to noisy sources such as cell phone charger, Halogen light, noisy desktop computer, vacuum cleaner, etc. These cases result in poor transmission speed.
- Unplug the device from the wall outlet and refer the product to qualified service personnel for the following conditions:
    - If liquid has been spilled into the product
    - If the product has been exposed to rain or water
    - If the product does not operate normally when the operating instructions are followed
    - If the product exhibits a distinct change in performance

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3 GETTING TO KNOW THE ADAPTER

3.1 The Ethernet Interface

Ethernet: The Ethernet port connects to an Ethernet network cable. The other end of the cable connects to your computer or other Ethernet-enabled network device.

3.2 The Adapter's Buttons

The following figure shows the adapter's buttons.

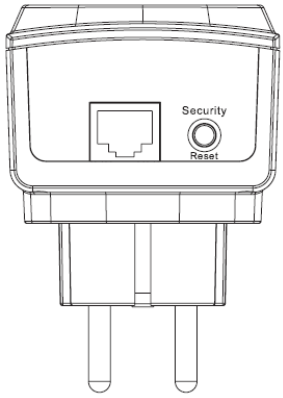

Figure 2 Side panel of the device

Security\Reset: Set the status of the device members or restore the factory default settings.

- Pressing and holding the **Security\Reset** button for less than 3 seconds makes the adapter a member of the existing AV Logical Network (AVLN). Pressing and holding the Button for between 10 seconds and 15 seconds makes the adapter restore the factory default settings.

3.3 The Adapter's LEDs

All adapters' LEDs are located on the front panel. There are 3 LEDs to indicate the adapter's status.

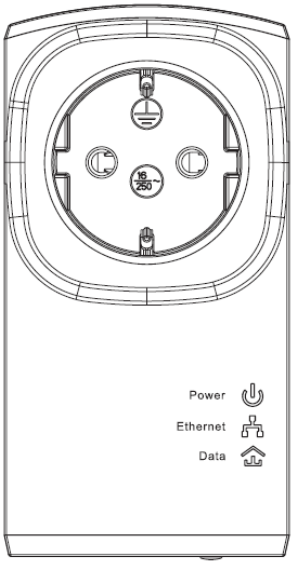

Figure 3 Top view

The following table describes the LEDs on the device.

LED	Behavior	Description
(Power)	Green ON	Device runs normally.
	Green Blink	Device is resetting or device is in the process of password synchronization.
	OFF	The PLC adapter is powered off.
(Ethernet)	Green ON	Ethernet connection has established.
	Green Blink	Data is being transmitted.
	OFF	No Ethernet connection.
(Data)	Green ON	The PLC adapter has connected to the powerline network.
	OFF	The PLC adapter does not connect to the powerline network.

Note:

When data is being transmitted, the Data indicator keeps on but does not blink.

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4 HOW TO INSTALL THE UTILITY

Note:

Before installing the PLC utility software, make sure that there is no any other powerline utility installed on your computer. If there is another utility installed, please uninstall it and restart your computer.

Follow the steps below to install the utility. No password or CD-Key is needed.

[R 1] Please insert the utility CD into the computer's CD-ROM drive. Select the **PLC 500AV Utility Installation** folder and then double-click the setup.exe. The page for installing the utility software is displayed.

Power Packet Utility
Welcome to the Power Packet Utility Setup
The installer will guide you through the steps required to install Power Packet Utility on your computer.
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.
Cancel
< Back
Next >

Figure 4 Open the setup wizard

[R 2] Click **Next** to display the following page.

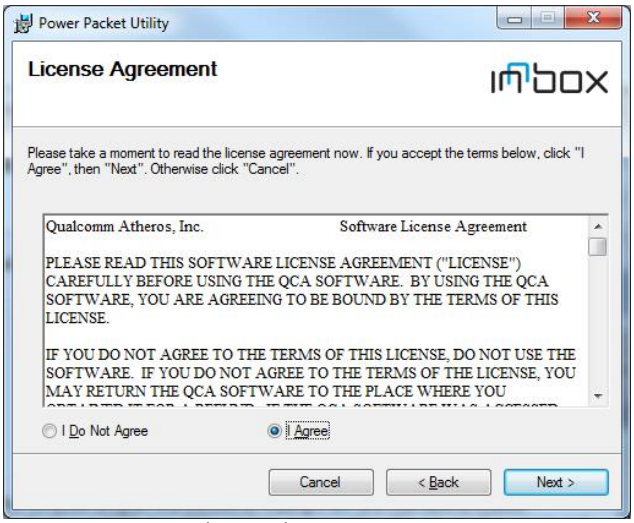
Power Packet Utility
License Agreement
Please take a moment to read the license agreement now. If you accept the terms below, click "I Agree", then "Next". Otherwise click "Cancel".
Qualcomm Atheros, Inc. Software License Agreement
PLEASE READ THIS SOFTWARE LICENSE AGREEMENT ("LICENSE") CAREFULLY BEFORE USING THE QCA SOFTWARE. BY USING THE QCA SOFTWARE, YOU ARE AGREEING TO BE BOUND BY THE TERMS OF THIS LICENSE.
IF YOU DO NOT AGREE TO THE TERMS OF THIS LICENSE, DO NOT USE THE SOFTWARE. IF YOU DO NOT AGREE TO THE TERMS OF THE LICENSE, YOU MAY RETURN THE QCA SOFTWARE TO THE PLACE WHERE YOU
I Do Not Agree
I Agree
Cancel
< Back
Next >

Figure 5 License agreement

[R 3] Select **I Agree** and click **Next** to display the following page.

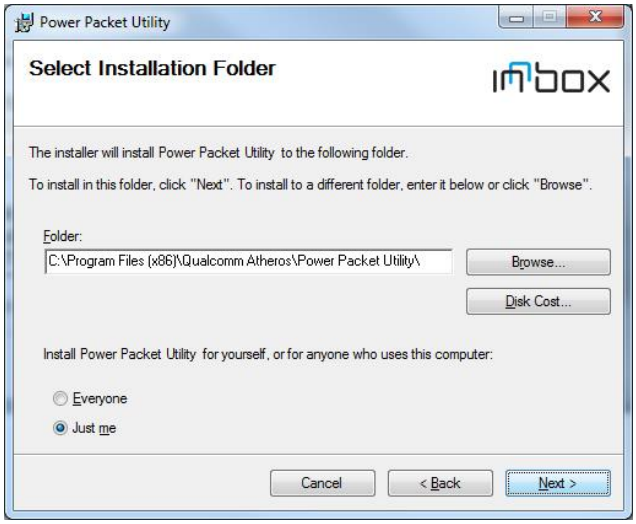
Power Packet Utility
Select Installation Folder
The installer will install Power Packet Utility to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Folder:
C:\Program Files (x86)\Qualcomm Atheros\Power Packet Utility\
Browse...
Disk Cost...
Install Power Packet Utility for yourself, or for anyone who uses this computer:
Everyone
Just me
Cancel
< Back
Next >

Figure 6 Selecting the folder

[R 4] Click **Browse…** to select the installation folder, and then click **Next** to continue.

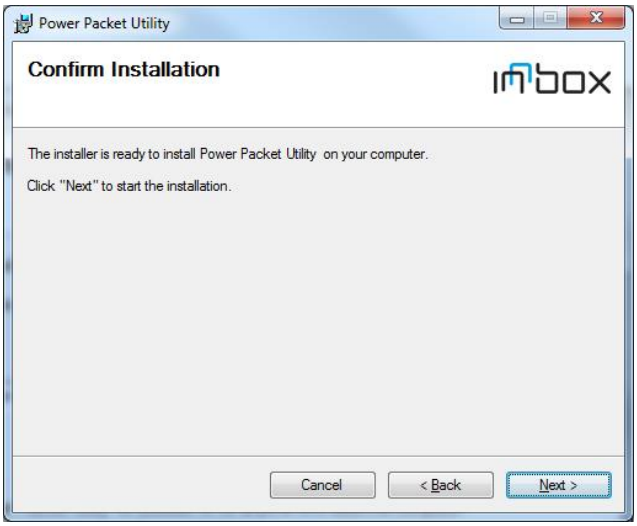
Power Packet Utility
Confirm Installation
The installer is ready to install Power Packet Utility on your computer.
Click "Next" to start the installation.
Cancel
< Back
Next >

Figure 7 Confirm installation

[R 5] Click **Next** to display the following page.

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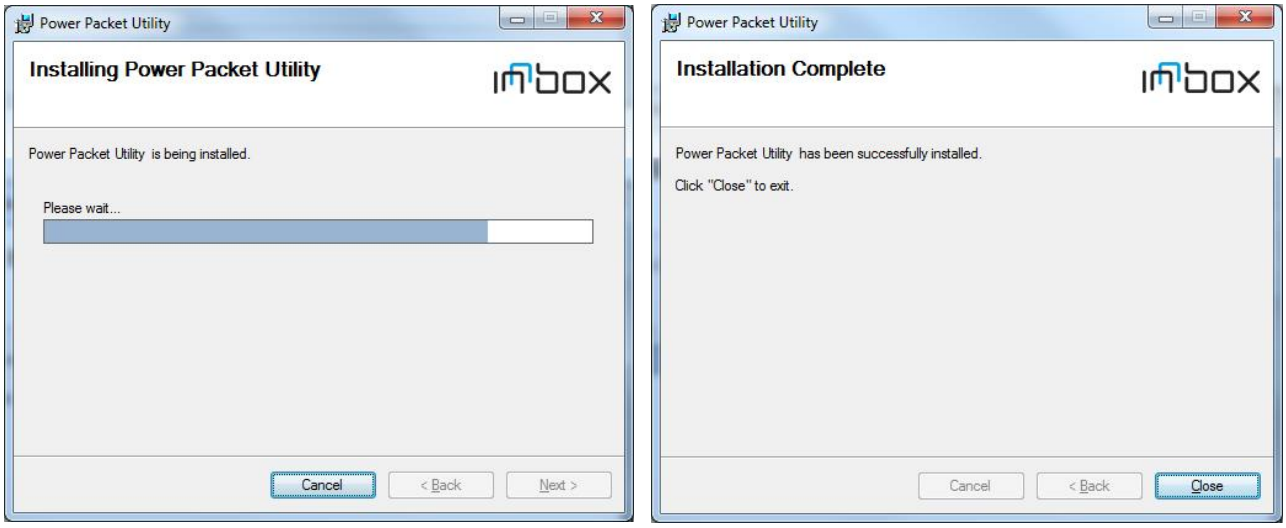

Figure 8 Completing the installation

[R 6] Click **Close** to finish the installation.

5 HOW TO USE THE UTILITY

Click the desktop icon below to enter the configuration page.

Figure 9 Desktop icon

5.1 Main Tab

The **Main** screen provides a list of all powerline devices logically connected to the computer when the utility is running.

The top panel shows the local HomePlugAV devices connected to the network interface card (NIC) of the computer. Click **Connect**. The utility automatically scans the powerline periodically for other HomePlugAV devices connected to it. If no local HomePlugAV device is discovered, the status bar displays **NO HOMEPLUG ADAPTERS DETECTED.**

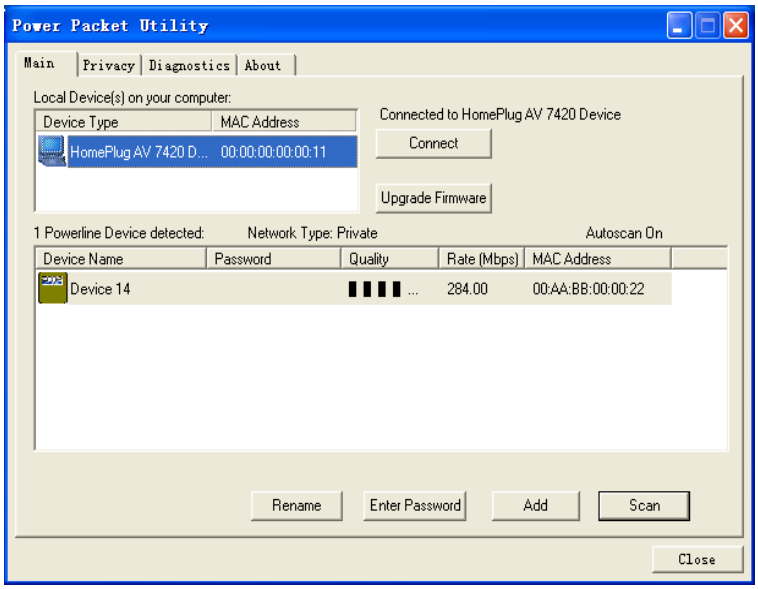

Figure 10 Main tab

The lower panel displays all the HomePlugAV remote devices, which are discovered in the current logical network. The total number of remote devices connected in the same network is displayed above the remote device panel. **Network type** (**Public** or **Private**) depends on the network status of the local device. **Autoscan** shows whether the autoscan function is on. The following information is displayed for all the devices that appear in the lower panel.

Device Name

This column shows the default device name, which may be modified. To change the name, click **Rename**, or click the name and edit it in the list.

MAC Address

This column shows the MAC addresses of the remote devices.

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Password

By default, this column is blank. You can click **Enter Password** to change it. The steps for setting the password of the device (required when creating a private network) are as follows:

- **STEP 1:** Click the device name to select the device in the lower panel.
- **STEP 2:** Click **Enter Password**. A dialog box appears, showing the device name and password. **Figure 11.**

Set Device Password
Device:
Device 14 (00:AA:BB:00:00:22)
Password:
The Password typically appears as a number and letter code, in groups of four, separated by dashes.
(ie XK8Y-GH26-BR1K-LZSA) It is found on the device or packaging.
OK
Cancel

Figure 11 Setting the device password

- **STEP 3:** Click **OK** to verify the password. The password field accepts the device password in any case formats, with or without dash.

A confirmation box appears if the password is entered correctly. If a device is not found, a message appears, providing suggestions to solve the common problems. This process might take a few seconds to get completed.

Add

This button is used to add a remote device to the existing network by entering the device password of the device. A dialog box appears. Figure 12. You can enter a device name and the password.

If the device is found and the password is entered correctly, a confirmation box appears. If a device is not found, a message appears, providing suggestions to solve the common problems.

Add Device to Network
Device Name:
Name
Password:
PASS-WORD-GOES-HERE
The Password typically appears as a number and letter code, in groups of four, separated by dashes.
(ie XK8Y-GH26-BR1K-LZSA) It is found on the device or packaging.
OK
Cancel

Figure 12 Adding the remote device

Note:

The device must be in the powerline (plugged in), so that you can confirm the password and add the device to the network. If the device is not located, a warning message appears.

Scan

This button is used to perform an immediate search for HomePlugAV devices connected to the powerline network. By default, the utility automatically scans every a few seconds and updates the displayed information.

5.2 Privacy Tab

In the **Privacy** screen, you can maintain security for the logical network and select the device included in the network. See **Figure 13.**

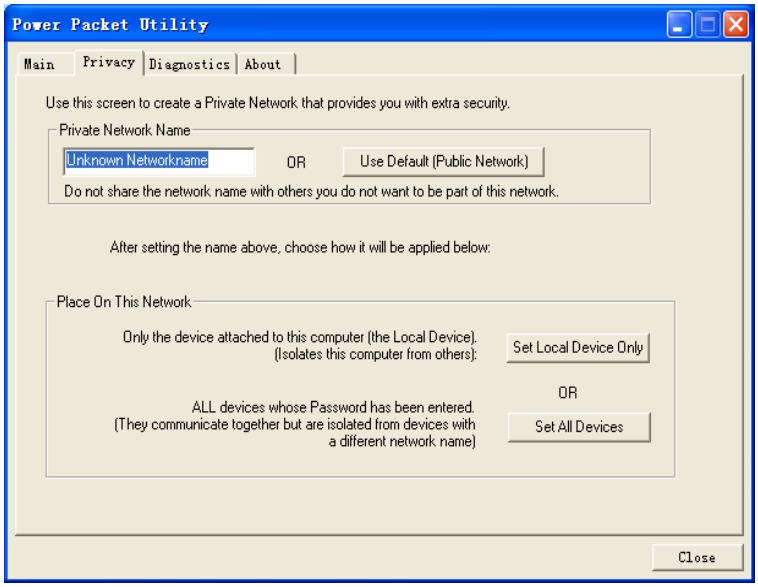
Power Packet Utility
Main
Privacy
Diagnostics
About
Use this screen to create a Private Network that provides you with extra security.
Private Network Name
Unknown Networkname
OR
Use Default (Public Network)
Do not share the network name with others you do not want to be part of this network.
After setting the name above, choose how it will be applied below:
Place On This Network
Only the device attached to this computer (the Local Device).
(Isolates this computer from others):
Set Local Device Only
OR
ALL devices whose Password has been entered.
(They communicate together but are isolated from devices with
a different network name)
Set All Devices
Close

Figure 13 Privacy tab

All HomePlugAV devices are loaded using a default logical network (network name), which is normally **"HomePlugAV"**. In the **Privacy** screen, you can modify a private network by changing the network names and the passwords of the devices.

You can always reset to the HomePlugAV network (Public) by entering "HomePlugAV" as the network name or by clicking on the **Use Default** button.

Note:

*If the network name changes to anything other than HomePlugAV, the network type in the main screen is displayed as **Private**.*

Set Local Device Only

This button is used to change the network name and password of the local device. If a new network password is entered, all the devices appeared in the main panel prior to this are no longer present in the new network, effectively making the local devices not to communicate to the devices which are in the old logical network. Click Set Local Device Only, the devices previously set up with the same logical network (same network name) appears in the device list.

Set All Devices

This button is used to change the logical network of all devices that appear in the main panel. If these devices whose passwords have been entered for the same logical network, a dialog box appears, indicating the success of this operation. For the devices whose passwords are not entered, this operation will fail and it will report a failure message.

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5.3 Diagnostics Tab

The **Diagnostics** screen shows the system information and history of all remote devices appeared over a period of time. See **Figure 13.**

The **Upper panel** shows technical data concerning software and hardware on the host computer that are used to communicate through HomePlug on the powerline network. It includes the following:

- Operating system platform/version
- Host network name
- User name
- MAC address of all NICs (Network interface card) connected to the host
- Identify versions of all driver DLLs and libraries used (NDIS) and optionally
- HomePlug chipset manufacturer name (Turbo Only devices)
- MAC firmware version (Turbo Only devices)
- MAC addresses of all devices connected locally to the host
- Version of the configuration utility
- Vendor name

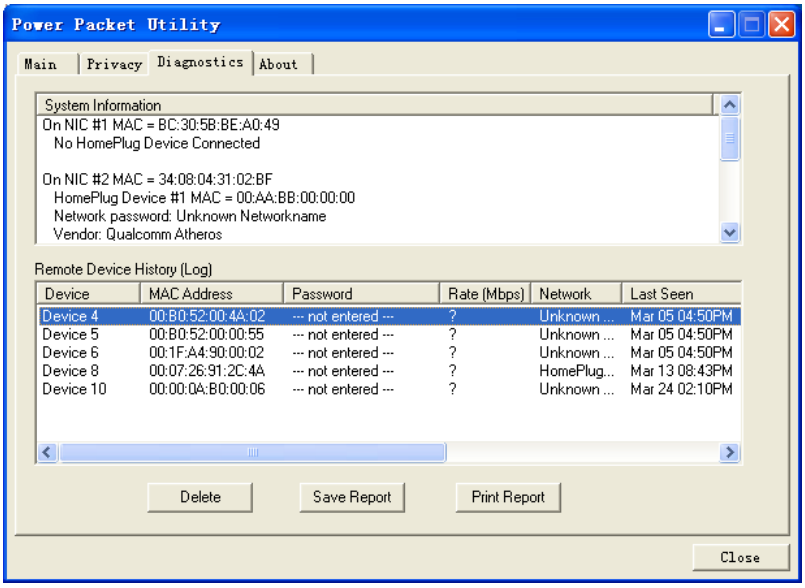
Power Packet Utility
Main
Privacy
Diagnostics
About
System Information
On NIC #1 MAC = BC:30:5B:BE:A0:49
No HomePlug Device Connected
On NIC #2 MAC = 34:08:04:31:02:BF
HomePlug Device #1 MAC = 00:AA:BB:00:00:00
Network password: Unknown Networkname
Vendor: Qualcomm Atheros
Remote Device History (Log)
Device
MAC Address
Password
Rate (Mbps)
Network
Last Seen
Device 4 00:B0:52:00:4A:02 --- not entered --- ? Unknown ... Mar 05 04:50PM
Device 5 00:B0:52:00:00:55 --- not entered --- ? Unknown ... Mar 05 04:50PM
Device 6 00:1F:A4:90:00:02 --- not entered --- ? Unknown ... Mar 05 04:50PM
Device 8 00:07:26:91:2C:4A --- not entered --- ? HomePlug... Mar 13 08:43PM
Device 10 00:00:0A:B0:00:06 --- not entered --- ? Unknown ... Mar 24 02:10PM
Delete
Save Report
Print Report
Close

Figure 14 Diagnostics tab

The **Lower panel** displays the history of all remote devices appeared on the computer over a certain period of time. All the devices and the parameters of the devices on the powerline network are listed. Devices that are active on the current logical network show a transfer rate in the rate column. Devices on other networks, or devices that no longer exist are shown with a "?" in the rate column. The following remote device information is available from the diagnostics screen:

- Device alias name
- MAC address
- Password
- Device last known rate
- Device last known network name
- HomePlug chipset manufacturer name
- Date device last seen on the network
- MAC firmware version

The diagnostics information displayed can be saved to a text file for later use, or be printed for reference for a technical support call. Click **Delete** to delete the devices which are no longer part of the network. A dialog window pops up with a confirmation message if the user wants to delete a device whose password has been entered.

5.4 About Tab

The **About** screen shows the software version and provides an html link to a website, such as *http://www.qua.qualcomm.com*. Clicking the web address, you can visit the web site.

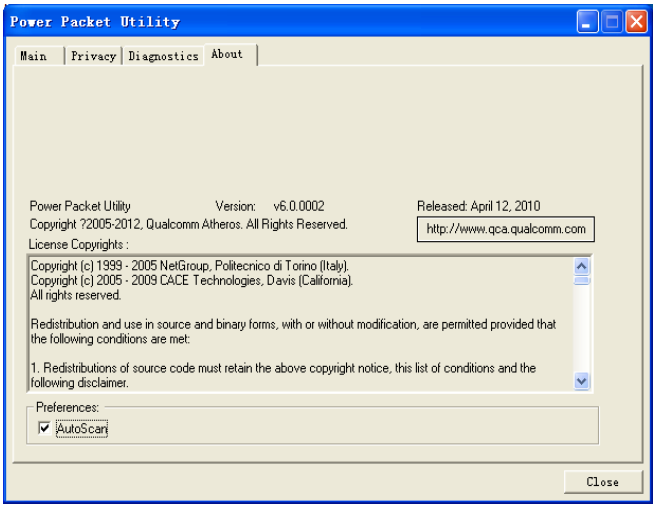
Power Packet Utility
Main
Privacy
Diagnostics
About
Power Packet Utility
Version: v6.0.0002
Released: April 12, 2010
Copyright ?2005-2012, Qualcomm Atheros. All Rights Reserved.
http://www.qca.qualcomm.com
License Copyrights :
Copyright (c) 1999 - 2005 NetGroup, Politecnico di Torino (Italy).
Copyright (c) 2005 - 2009 CACE Technologies, Davis (California).
All rights reserved.
Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:
1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
Preferences:
AutoScan
Close

Figure 15 About tab

Preferences

The lower part of the panel displays options for turning the autoscan function on or off.

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6 FORMING A HOMEPLUG AV LOGICAL NETWORK

This chapter describes how to form a HomePlug AV logical network (AVLN) using the Security/Reset pushbutton and using the Utility.

Operation progress and outcome can be monitored by observing the behavior of the power LED.

6.1 Using the Security\Reset Pushbutton

Scenario:

Devices A and B with different NMK values are connected to the same powerline. Users want to use them to form a logical network.

Figure 16 Forming a HomePlug AV logical network

Do as follows to form a logical network using the Security/Reset button:

- **STEP 1:** Press the **Security\Reset** button on Device A for less than 3 seconds.
- **STEP 2:** Press the **Security\Reset** button on Device B for less than 3 seconds. The button on B must be pressed within 2 minutes
- **STEP 3:** Wait for connection to complete.

The Power indicator on both devices will flash evenly at 1 second interval until the operation succeeds or fails. The Power indicator will illuminate steadily on successful completion. If an error occurs, the Power indicator on both devices will flash unevenly for 2 minutes.

6.2 Using the Utility

Scenario:

Devices A and B are located in different networks. Users want to use them to form a logical network.

In this case, using the Security/Reset pushbutton cannot pair Devices A and B. Users can only use the Utility to form a logical network.

Do as follows to form a logical network using the Utility:

- **STEP 1:** Connect Device A to the network card of a PC.
- **STEP 2:** Open the Utility. The Main tab page displays information about Device A after connection succeeds.

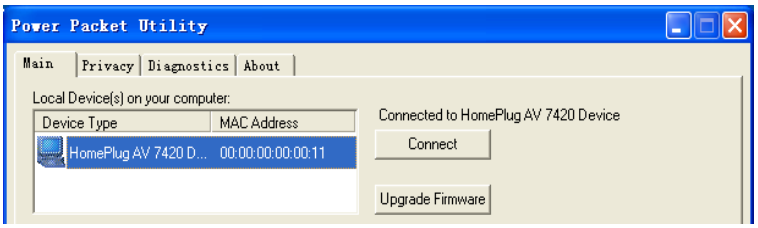

Figure 17 Local device on your computer

- **STEP 3:** Click the **Privacy** tab page. Enter a name in the **Private Network Name** field.

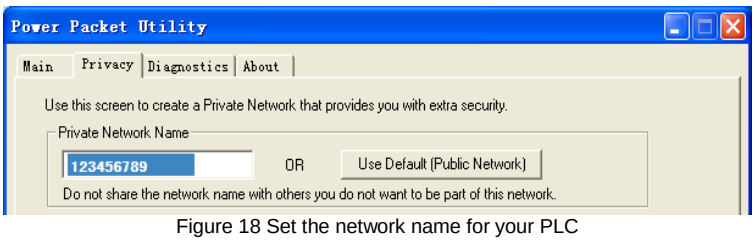
Power Packet Utility
Main
Privacy
Diagnostics
About
Use this screen to create a Private Network that provides you with extra security.
Private Network Name
123456789
OR
Use Default (Public Network)
Do not share the network name with others you do not want to be part of this network.

Figure 18 Set the network name for your PLC

- **STEP 4:** Click **Set Local Device Only**. When the following page is displayed, the setting succeeds. Now Device A has been removed from its logical network.

Figure 19 Network name setting success

- **STEP 5:** Repeat the procedures above to configure Device B. Configure Device B with the same **Private Network Name** as Device A. After the operation succeeds, Devices A and B form a new logical network.

7 JOINING A NETWORK

This chapter describes how to add a device to an existing HomePlug AV logical network (AVLN) using the Security/Reset pushbutton and using the Utility.

Operation progress and outcome can be monitored by observing the behavior of the power LED.

7.1 Using the Security\Reset Pushbutton

Scenario:

Devices A and B are located in network N. Device C (the joiner) that is not located in any networks attempts to join Network N. Any devices on Network N can become the 'adder'.

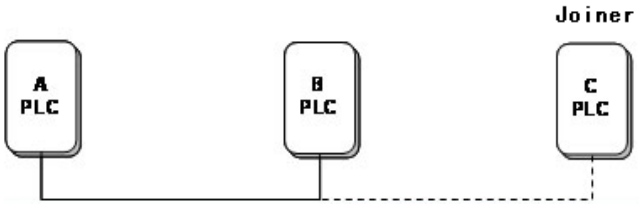

Figure 20 Joining a network

Do as follows to add Device C to Network N using the Security/Reset button:

- **STEP 1:** Press the **Security\Reset** button on Device A (or Device B) for less than 3 seconds, making it the 'adder'.
- **STEP 2:** Within 2 minutes, press the **Security\Reset** button Device C (the 'joiner') for less than 3 seconds.
- **STEP 3:** Wait for connection to complete.

The Power indicator on Device A (or Device B) and Device C will flash at 1 second intervals until the process succeeds or fails. It will illuminate steadily on success. If an error occurs, the Power indicator on Device A (or Device B) and Device C will flash unevenly for 2 minutes.

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7.2 Using the Utility

Scenario:

Devices A and B are located in Network N. Device C (the joiner) that is located in another network attempts to join Network N. See

Do as follows to add Device C to Network N using the Utility:

- Connect Device C to the network card of a PC.
- Open the Utility. The **Main** tab page displays information about Device C after connection succeeds. See **Figure 17**.
- Click the **Privacy** tab page. Enter a name in the **Private Network Name** field. See **Figure 18**.
- Click **Set Local Device Only**. When the page as shown in **Figure 19** is displayed, the setting succeeds. Now Device C has been removed from its logical network.
- Press the pushbutton on Device A or B for less than 3 seconds, making it the 'adder'.
- Within 2 minutes, press the pushbutton on Device C (the 'joiner') for less than 3 seconds.
- Wait for connection to complete.

The Power indicator on Device A (or Device B) and Device C will flash at 1 second intervals until the process succeeds or fails. It will illuminate steadily on success. If an error occurs, the Power indicator on Device A (or Device B) and Device C will flash unevenly for 2 minutes.

8 HOW TO IMPROVE THE TRANSMISSION CAPACITY

It is important to use the PLC product complying with the following "correct rules", because it can significantly improve the transmission capacity of the network.

For the PLC device without female socket, it is recommended to plug the device directly into a wall socket, not to power stripe.

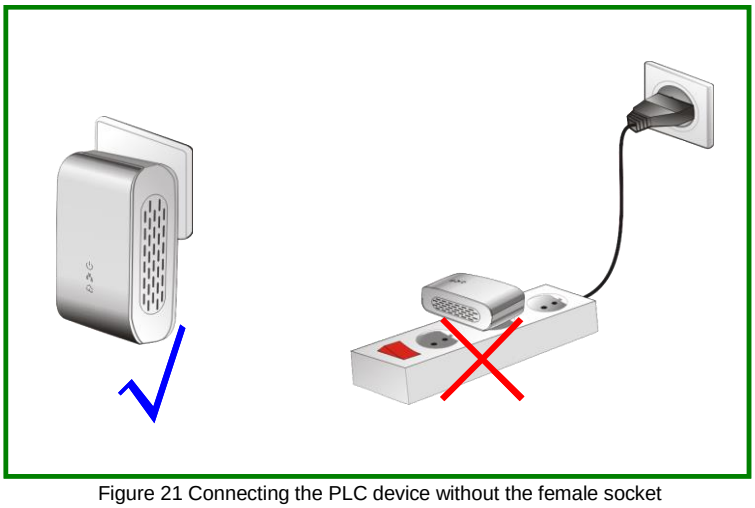

Figure 21 Connecting the PLC device without the female socket

APPENDIX A: SPECIFICATIONS

Chipset	Atheros AR7420
Protocol	HomePlug AV, IEEE1901 Co-exists with existing HomePlug 1.0
System Support	Windows 98SE, 2000, ME, XP 32/64 bit and Vista 32/64bit
PLC PHY Rate	500Mbps (Max)
Modulation Band	2~68MHz
Modulation Schemes	Supports OFDM 4096/1024/256/64/16/8-QAM, QPSK, BPSK and ROBO
Encryption	128 AES
LED's	Power Ethernet Data
Push Button	Reset: Restore the factory default settings Security: Set the network password automatically
Consumption	3W
Operating Temperature	0ºC to 40ºC
Storage Temperature	-20ºC to 70ºC
Operating Humidity	10% to 90%, non-condensing
Storage Humidity	5% to 95%, non-condensing
Input Rating	100-240 VAC, 50/60Hz
Certifications	CE, UL, FCC Part 15 Class B
Green Standard	RoHS
Physical Dimension	L×W×H: 117mm×60mm×47.8mm
Weight	180g

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APPENDIX B: ACRONYMS AND ABBREVIATIONS

AVLN	AV In-home Logical Network, the AVLAN is the set of STAs that possess the same network membership key. Every AVLN is managed by a single CCo.
CCo	Central Coordinator
CSMA/CA	Carrier Sense Multiple Access / Collision Avoidance
DAK	Device Access Key
DM	Device Manager
IGMP	Internet Group Management Protocol
NEK	Network Encryption Key
NID	Network ID (Identification)
NMK	Network Membership Key
PLC	Powerline Communication
PIB	Parameter Information Block
STA	Station, a STA in the network with a connection to the powerline and being able to source or sink traffic
TDMA	Time Division Multiple Access
TEI	Terminal Equipment Identifier
TOS	Type Of Service
VLAN	Virtual Local Area Network

APPENDIX C: ABOUT QOS

PLC 200AV allows for 4 levels of Channel Access Priority (CAP (0 – 3)). The 8 levels of VLAN Ethernet tags must be mapped to the 4 levels of CAP priority, where CAP 3 is the highest priority and CAP 0 is the lowest. CAP 3 priority might be used for voice and network management frames, and CAP 2 is used for streaming video and music while CAP 1 and CAP 0 are used for data.

Default CAP

The 'Default CAP' group allows for default priority mapping of packets that do not have a VLAN TAG. The settings are available for Unicast (directed to a host).

- IGMP - (default CAP 3) - sets the channel access priority for IGMP frames - these are the group management frames, not the stream data.
- Unicast - (default CAP 1) - sets the default channel access priority for unicast frames not matching any other classification or mapping.
- IGMP managed Multicast Stream (Fixed to CAP 2) - sets the default channel access priority for stream data belonging to a snooped IGMP multicast group.
- Multicast/Broadcast - sets the default CAP for multicast frames not in a snooped group and for broadcast frames.

The following are the factory default settings for VLAN Tags and TOS Bits:

VLAN Tag User Priority	Default CAP Priority	TOS Bit User Priority	Default CAP Priority
0	CAP1	0	CAP1
1	CAP0	1	CAP0
2	CAP0	2	CAP0
3	CAP1	3	CAP1
4	CAP2	4	CAP2
5	CAP2	5	CAP2
6	CAP3	6	CAP3
7	CAP3	7	CAP3

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